

The Market's Reaction to Investments in Blockchain

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By

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Abstract

Blockchain is a secure, transparent digital platform used to verify transactions. Each transaction is recorded, verified into a “block”, and then added to a pre-existing ledger, or “chain”. In recent years many prominent companies have announced that they are investing in blockchain for applications ranging from financial transactions to supply chain solutions and data transferring. The purpose of this research is to better understand how much value this new technology can add to a business. In this paper, we investigate the effect that announcing an investment in blockchain has on the market value and stock price of a publicly-traded firm using the event study methodology first introduced by Fama, French, Jensen, & Roll (1969). We have collected a data set of fifty-three publicly-traded firms’ stock prices and market capitalizations from twenty days before to twenty days after they made their announcement. We plot their returns against the S&P 500 index to see if these companies exhibited statistically significant abnormal returns greater than the market in the twenty days after their announcement. We find that smaller firms tend to exhibit higher abnormal returns than larger firms in the twenty days after announcing their association with blockchain technology. The values of micro-cap stocks (stocks with a market cap less than \$100 million) increase by 136.73% on average, and that of small-cap stocks (stocks with less than \$1 billion in market cap) increase by 36.64%, while larger firms like Microsoft and IBM barely see any movement in their stock prices after their announcements. Our findings suggest an investment in blockchain leads to a large, statistically significant increase in stock price and market value for smaller firms, but not for larger firms.

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Introduction

Blockchain is a relatively new technology that has the promise to change how we do business. It is the technology behind cryptocurrencies. It's used for carrying out financial transactions, storing data, tracking supply chains, and so much more. But what is it worth? Enterprises around the world are investing millions in blockchain as a way to make their businesses better. As they do so, investors and creditors are trying to value these investments and determine how much they can improve a business's profitability and security. Companies frequently make headlines for their impressive stock returns after announcing involvements in blockchain. Signaling a pivot to a more blockchain-centric business, longtime beverage maker Long Island Ice Tea changed their name to Long Blockchain and subsequently saw their stock price increase by over 180%. Returns like this beg the question: does an investment in blockchain result in a company's stock price increasing by a significant amount? This research is focused on finding out whether or not investing in blockchain increases the long-term value of the firm, or if it's just much ado about nothing.

Literature Review

This research project is about two elements. First, it's about companies investing in an exciting emerging technology, and second, it's about investors initially valuing this adoption. The last time we saw a technology like this was in the 1990s with companies adopting the internet in what is known as the "dot com" era. Cooper et. al. (2001) find that companies that change their name to add ".com" see abnormal returns of 74%. There are instances of firms changing their name to something blockchain-related and subsequently experiencing large returns. For example, Bioplix changed its name to Riot Blockchain and saw its stock price

increase by over 400%. Cooper et. al (2001) concludes that these abnormal returns were caused by investor mania. They found that companies with little or no internet sales experienced the greatest long-horizon returns.

Cooper et. al (2001) also draws comparisons between the dot.com boom and previous bubbles such as the mining and railroad stocks in the 1850s and science and technology stocks in the 1960s, pointing out that the common thread in all of these bubbles is that they are all in new exciting industries with high growth potential. This description applies to blockchain as well. Just like the late-1990s, investors are tasked with valuing a promising new technology with a high degree of uncertainty. It's possible that things like the appreciation of bitcoin, and companies associated with blockchain experiencing rapid stock price appreciation are signs of yet another technology-related bubble, or it could be that these prices are rational.

Horsky and Swyngedouw (1987) and Lee (2001) both find that firms that change their name experience improved stock performance. Lee (2001) offers a few different reasons as to why stocks that changed their name saw a sharp rise in price. Usually when a company changes its name, it also changes its strategy and business objectives. The stocks that invested time and money immediately into the internet concurrently with changing their name saw a larger abnormal price increase and trading volume than the stocks that didn't couple their name change with these investments. The main takeaway is that changing the name isn't as important for the stock in the long-term as making investments or developing new strategies around the new technology. One of the main goals of this research is to see if investing in blockchain has a similar effect and whether or not this is consistent with investors viewing the potential of blockchain for business the way they once looked at the internet and the possibilities that came with that technology. The article also discusses that the internet may not add nearly as much

value to firms as investors seem to think it will. If this were to be the case, eventually, companies that changed their name to add a “.com” would see smaller and smaller effects on their stock price. Finally, it brings up the important caveat that the market in the late-90s was incredibly bullish, so impressive returns in the price of a single firm’s stock need to be put in context with the returns the market was seeing. This consideration is important to keep in mind today as well. Many of the firms in our data set announced their intentions to work with blockchain during a bull market and at a time when bitcoin’s value was increasing.

Chuen et. al (2017) finds that investor sentiment affects pricing and returns of cryptocurrencies, the most famous use of blockchain. They analyzed 100 different cryptocurrencies and find that when investor sentiment surrounding a given cryptocurrency is high, its subsequent returns are lower than average for the following year and that when investor sentiment around a given cryptocurrency is low, subsequent returns for that cryptocurrency are higher. This means that cryptocurrencies that investors are excited about tend to be overpriced in the near-term. Given that the prices of cryptocurrencies, notably bitcoin, are increasing during the time period that this study is done, investor behavior regarding blockchain-related businesses may be similar to that regarding cryptocurrencies in that sentiment may initially be high around these companies leading to overvaluation and relatively low returns in the following year.

It is too early to say whether investing in companies that invest in blockchain is a sound strategy, but research has been done to show that investing in cryptocurrencies could be profitable and that investors should allocate more of their portfolio to these types of assets. Chuen et.al (2017) find that investing in cryptocurrencies based on sentiment could outperform the market with a relatively low Sharpe ratio as well. Liew et. al (2017) analyze the returns of bitcoin specifically and find it has a Sharpe Ratio of 1.176 and make the case that institutional

investors should hold more bitcoin than they currently do. Perhaps investing in companies in the blockchain space is a similarly viable strategy, and any price appreciation observed would be a sign of this.

When considering if it's possible that investors are overpaying for a firm's stock after it announces an investment in bitcoin, it's important to understand when investors might overpay for a stock. Extensive research has been done on investors' tendency to overpay. Peng and Xiong (2006) states investors only have a limited amount of cognitive energy to spend on deciding where to put their money. As such, they tend to spend more time looking at the market and the sector that the firm is in, rather than looking at the firm itself. They form investment styles whereby they put their money into a certain "type" of stock rather than looking closely at the firm itself. This means that retail investors tend to be attracted to a handful of characteristics about a firm and will pay for those, rather than valuing the firm holistically and coming up with an intrinsic price. Investors may also be overconfident when making investment decisions of this nature, particularly when the characteristics they are valuing stocks on are difficult to value. Blockchain investments may be one of these special characteristics. What happens to a stock after it announces an investment in blockchain may have less to do with the characteristics of the firm itself and more to do with the strength of its association with blockchain. The uncertainty of the true limits of blockchain's potential could also cause some investors to overvalue the technology itself leading to overpricing of specific securities related to it.

Hypotheses

The question this research aims to answer is: What happens to a company's stock price immediately after it announces it is going to invest in blockchain technology? The explanatory variables will be the announcement and size of firms' investment in blockchain technology, and the response variables will be firms' stock price.

Our hypothesis is that companies that announce an investment in blockchain technology will see their stock price and trading volume immediately increase by an unusual amount but then decrease in the subsequent weeks. This may be caused by the initial overvaluation of the value of blockchain technology to a firm from excited investors who believe that the technology will significantly improve a firm's operations.

Methodology

Research Design:

We performed an event study on a sample of 53 companies that trade publicly on US exchanges. We have collected publicly available secondary data related to the companies' stock price and trading volume twenty days prior to and after the event of a company announcing an investment in blockchain.

Sample:

We used a sample size of 53 blockchain investment events from publicly-traded companies that are listed in the US. For the purpose of this research, an event is defined as any announcement by a company signaling that it is associating any part of its business operations

with blockchain. This association with blockchain can be anything from a company planning exploratory research on how it can integrate blockchain into a business process all the way to a company changing its name and signaling a complete redefinition of its business altogether.

Documentation of events where publicly-traded companies invest in blockchain are found either through formally filed 8-Ks with the SEC or more informal press releases. To find them we used Google and searched the SEC database. Then, we collected the names of companies that trade on US exchanges that have made such investments on a spreadsheet and gathered more specific data about them.

Measurements:

The explanatory variables are the announcement date of firms' investment in blockchain technology, and the response variables are firms' stock price, trading volume twenty days before and twenty days after the event, and market cap throughout the 40-day horizon. Companies are further classified based on their market cap on the day prior to the announcement going public. If the company's market cap is above 30B, then, it is classified as a large company. There are $N = 27$ of these firms in our data set. If the market cap is between 1B and 30B then it is a medium-sized company ($N = 12$). If the company is between 100M and 1B, it is a small company ($N = 7$), and if the company has a market cap of less than 100M, then it is a micro company ($N = 8$). We also collected the price and trading volume of the S&P 500 index as a whole twenty trading days before and after the event.

Detailed Study Procedures:

All data used is publicly available historical data on stocks traded on US firms. We find companies that have made investments in blockchain through google searches, press releases, and 8-K SEC filings, carefully noting the exact dates of the announcements. This is the event date for our data set. Next, using Yahoo Finance, we pulled the adjusted closing stock price and trading volume of the company of interest from twenty days prior to the event to twenty days after the event. Then we pulled the adjusted closing index value and trading volume of the S&P 500 for the corresponding forty days of interest around the event. We compiled all of this into a spreadsheet that has the following columns:

Stock	Days Since Event	Stock Price	Stock Return	Stock Volume	S&P 500 Price	S&P Return	S&P 500 Volume	Date
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The final data set for this analysis has forty-one lines of stock prices and trading volumes at day of close for each of the fifty-three stocks in the sample, as well as the corresponding values of the S&P 500 index for those days. This is 2173 lines of data.

Internal Validity:

To test for the validity of my final data set, we took samples of the data set. Picking three stocks, we randomly checked 123 lines or 5.7% of the 2173 lines of the total data set and found there to be no errors in the data set regarding stock price and volume.

Data Analysis:

This research was done as an event study. An event study is a statistical technique in finance that tests the impact of an event on a firm's value and proves whether or not a particular event created abnormal returns for the firm. In this case, my event will be the firm's investment in blockchain. The way that this is done is by comparing the stock price after an event occurs to the stock price

before the event, or by comparing the return of the stock after an event to the return of the stock if the event had never happened. The event study was first used in Fama, Fisher, Jensen, and Roll (1969). That paper says that the deviations from an asset's expected return from period to period should have a mean of 0, and that market factors affect all firms. So, for a firm to experience abnormal returns in a period, its returns would have to exceed its normal level of expected returns as well as the expected return on all market assets. If over a certain number of periods, the firm consistently achieves abnormal returns above what is usual with statistical significance, then the event study would conclude that the event had some quantifiable effect on a firm's value. This methodology is the most logical one to use to test whether or not investment in blockchain produces abnormal returns in stock price. It's been well tested and holds up over decades of use and scrutiny.

Data Analysis

The simple average excess return on the day of the event is 58% for our whole data set. For no other day in the twenty-day window we look at is the excess return over 2%. This effect is due entirely to small and micro-cap stocks. On average, medium and large stocks see little returns in excess of the market. However micro stocks see an average excess return of 386%, and small stocks see an excess return of 16% on day 0. From this, we see that any significant effect on stock price as a result of an announcement in blockchain is only likely to happen to companies with very small market caps.

Next, we analyze whether these small and micro-cap companies earned abnormal returns over the twenty days following their announcements. All of these announcements were made

between March 2017 and May 2018. Below are all of the small and micro-cap stocks in our dataset and their CAR from 20 days before the event to 20 days after the event.

(Table 1)

Micro Stocks	CAR_(-20 to 20)
RCGR	2241.11%
LFIN	491.16%
NETE	235.14%
SRAX	154.19%
LBCC	141.86%
NVFX	30.52%
FTFT	-21.38%
MARA	-74.38%

(Table 2)

Small Stocks	CAR_(-20 to 20)
KODK	117.72%
RIOT	63.96%
OSTK	38.85%
GCAP	24.67%
QIWI	23.79%
XNET	2.50%
MGI	-15.03%

The average CAR for the micro stocks is 399.78%, but with RCGR being such a huge outlier, in part due to its incredibly low price, we conducted our statistical analysis without it. The average CAR for small stocks was 36.64%.

(Table 3)

	Large Stocks	Medium Stocks	Small Stocks	Micro Stocks	All Stocks
N	27	12	7	7	53
Average CAR	2.21%	3.71%	36.64%	136.73%	24.87%
t-stat	1.9925	1.3578	2.2173	1.9045	2.2467
p-value	0.0285	0.1008	0.0342	0.0528	0.0145

Above, we can see the t-stats and p-values for each size of stock in the sample, as well as the t-stat and p-value of the entire data set. From this, we can see that large, small and micro-cap stock all had statistically significant returns at the $\alpha = .1$ level.

As a test for robustness, we removed the top and bottom-performing stock from each subset of the data and reran the t-tests. In all cases, this makes the data look better. This is because taking out the top and bottom performers reduces the variance of the data by a greater

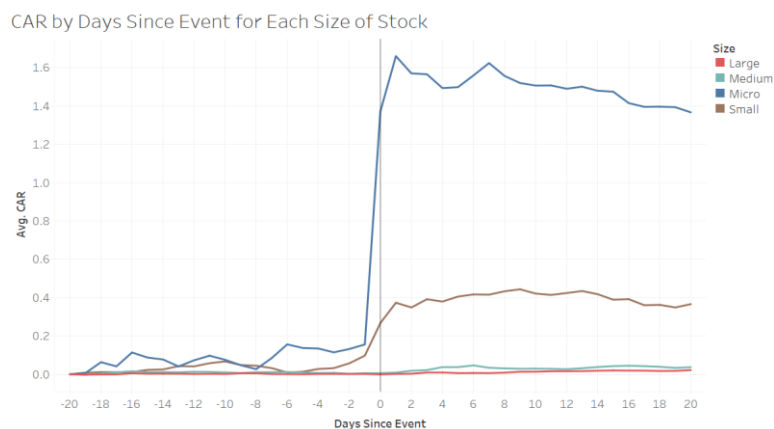
amount than it affects the mean of the data sets. Reducing variance without affecting the average will increase the t-stat and lower the p-value.

(Table 4)

	Large Stocks	Medium Stocks	Small Stocks	Micro Stocks
N	25	10	5	5
Average CAR	2.19%	3.28%	30.76%	108.07%
t-stat	2.3032	1.4084	3.0365	2.3529
p-value	0.0151	0.0962	0.0193	0.0391

One concern with these results is that because they occur so closely together, the announcement events might not be independent, which is an implicit assumption in using a t-test. However, Binder (1998) synthesizes a number of studies that all conclude that when the event observation period is short relative to the abnormal return estimation period, then the uncorrected t-stat would exceed the corrected t-stat by 1.6%. In this study, our event period is 1 day, and our observation period is 40 days. Our observation window is sufficiently large enough that even if there are questions about the independence of these events, studies suggest that we can still trust the results because our observational window is large enough that the results are still significant.

Results



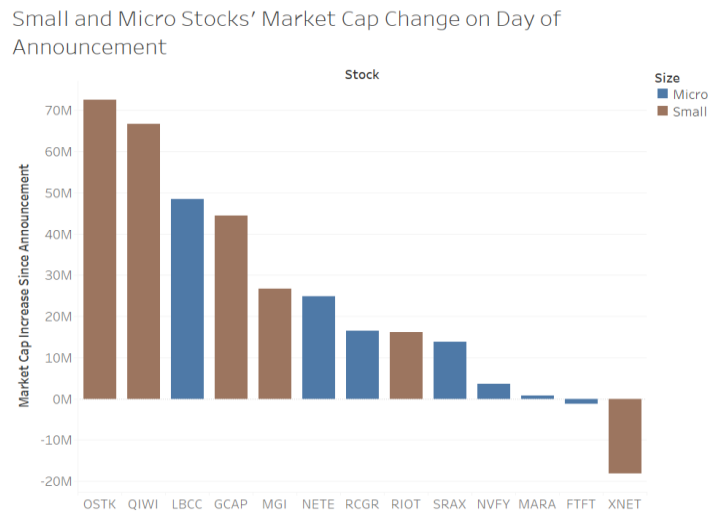
(Figure 1)

Illustrated above are the cumulative abnormal returns for all sizes of stock. At the bottom are the CARs for medium and large-cap stocks. From this we can see that even though large stocks have statistically significant abnormal returns, due to their small scale these may not be caused by anything related to their blockchain announcement. There may be other reasons why these 27 large-cap stocks outperformed the S&P 500 over this timeframe.

Only small and micro-cap stocks see any real effect on their stock price due to announcing an investment in blockchain. For small stocks, the CAR is positive from one day before the announcement until the end of the window. For micro stocks, the CAR is positive as early as 6 days before the announcement date on average. There are some plausible explanations for this. It's possible that we have gotten the dates wrong on when gathering the data. It could simply be noise due to how small the sample size is. However, abnormal returns prior to the announcement could also be a sign of some insiders close to these firms buying stock before the information is publicly available. Cooper, Demitrov and Rau (2001) found similar results when analyzing returns of publicly traded companies that changed their name to signal involvement with the internet during the dot-com bubble of the late 1990s. During the dot.com era, firms also experienced pre-announcement abnormal returns. It's impossible to definitively say that the price movement is caused by insiders trading on information before it's been made public, but it is a possibility.

An additional note of interest is the fact that both small and micro stocks see further excess returns one day after the announcement. This is likely due to the fact that because these firms are small and not in the news often, many investors don't learn about these firms' investment in blockchain until a day later. The excess returns could be due to momentum as well.

Another reason for why larger firms may not experience any large, immediate changes in stock price is that because of the current limited capability of blockchain for business use, it's not yet clear how much value blockchain can add to a firm. Below is a graph showing the market cap increase from the time of the announcement until five trading days after.



(Figure 2)

This is to give a sense of how much value investors thought that blockchain investment would add to these firms at the time of announcement. The average market cap increase was \$24.24MM with small cap firms seeing a larger increase in market cap than micro-cap firms. There are two outliers removed from this chart, and the calculation of the average. The first is LFIN, who experienced a market cap increase of \$1.57B, and the second is KODK who experienced a market cap increase of \$271MM.

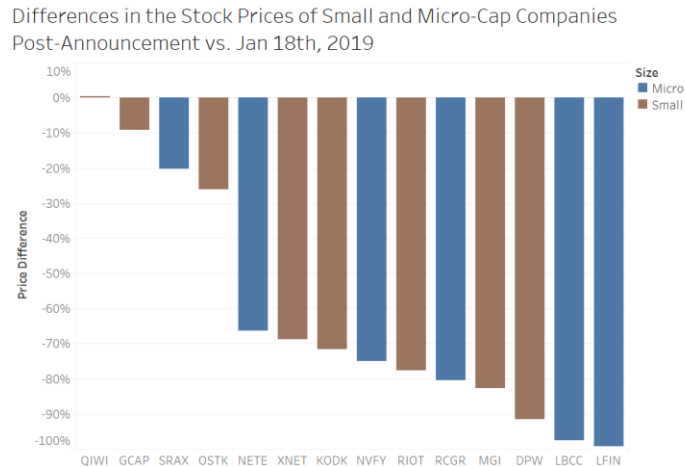
A \$25M increase in firm value has a huge effect on smaller firms, but it isn't noticeable in the stock price of larger firms. Perhaps the reason we don't observe much movement in the stock price of large firms is that investors agree that the amount of value blockchain can add to a firm doesn't scale proportionally with firm size. For the stock price of large cap firms to see any

significant increase, blockchain investments would have to add billions of dollars' worth of value. There isn't anything about the way that we can currently use blockchain that suggests that this is likely. Another thing to note is that four of these firms (NVFY, MARA, FTFT, XNET) saw either no change in market cap, or a decline in market cap in subsequent trading days. These firms also didn't experience any significant increase in market cap from their announcement.

Discussion

The goal of this research was to learn if investments in blockchain add value to firms in the way of sustained excess returns, or if investors simply trade irrationally around the news of companies that invest in new technology. To find out, we performed an event study, which over time has shown to be an effective method for detecting and analyzing the effect of specific events on stock prices. What we found is that when larger companies (those with a market capitalization of over \$1B) announce that they are going to begin working with blockchain, there is almost no discernable market reaction. However, firms that have much smaller market caps, and don't trade on major exchanges see a large, statistically significant increase in their stock price and market capitalization after announcing that they will work with blockchain.

It's not easy to say how rational these large price increases are. Almost all of the small and micro-cap firms in our data set have lower stock prices today, almost a year after their announcements, than before they announced a shift in their business strategy to incorporate blockchain.



Whether or not this means that investors acted irrationally when they invested in these companies in the first place, or that they did act rationally but these companies couldn't fully realize any long-term value due to other reasons isn't completely clear. Part of the investor mania in blockchain has to do with the excitement of a new technology and its potential to change the way business is done. Valuing a new technology like this is very difficult, particularly when uses for it are still being found. Blockchain hasn't yet been the revolutionary technology that investors thought it was when they invested in these small and micro companies, and because of that, these firms really haven't been able to realize the value that investors had once hoped.

Future Research

There are some ways that this research could be strengthened. One would be to collect a larger sample size of small and micro-cap companies to repeat this analysis on. This paper only looks at 13 such companies, which is all of the publicly-traded companies with reliable data we were able to find at the time of this study. As such, we are unable to see whether factors like industry, level of investment, or region of origin affect how these companies' stock prices react to announcements. A larger sample of these small companies could provide more insight into that. Another way to strengthen this research would be to expand the window of interest in the

event study to greater than 20 trading days. Expanding the window further could potentially bear out trends not seen in when only looking at 20 days. For instance, we may observe a drop-off in stock price a little while after the initial increase. There are 252 trading days in year, or roughly 63 per quarter. If the window was extended, we could study what happens the first time companies announce earnings and release financial statements post-announcement.

There are also some ways to expand this research. One way would be to analyze announcements made during a bear market. The timeframe of the analysis presented is between September 2015 and February 2018. During this time, the US stock market was experiencing its longest bull market in history, and the price of bitcoin was rising. This means that almost all stock prices were increasing and anything blockchain or bitcoin-related would have been looked at favorably. Perhaps investors are more skeptical about investments in blockchain in a bear market or when cryptocurrency prices are in freefall. Another way to expand this research is to study companies in foreign countries. This research focused on companies trading in the US, but regulations around cryptocurrencies, financial transactions, business, and blockchain in general differ widely across the world. Perhaps it would be worth seeing if conclusions are different in other parts of the world. It may also be worth looking into non-publicly traded companies such as startups to see how venture capitalists or private investors value blockchain investments. Maybe because investors of non-publicly traded companies are different, their reaction to the blockchain initiatives of those companies will be as well. Lastly, this research could be repeated with initial coin offerings. How does raising money by creating and selling a cryptocurrency affect the valuation of a company? For this it would likely be necessary to branch out beyond just publicly-traded companies as this is an increasingly common way for younger firms to raise capital.

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